

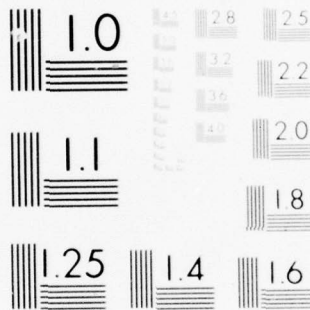
AD-A043 697 ARMY COMMAND AND GENERAL STAFF COLL FORT LEAVENWORTH KANS F/G 5/9
IS A CHANGE IN THE TACTICAL TRAINING OF MARINE CORPS ATTACK HEL--ETC(U)
JUN 77 6 A ROSS

UNCLASSIFIED

NL

Age
Sex
Education

END
DATE
FILMED
9-77
DDC



MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER X	2. GOVT ACCESSION NO. X	3. RECIPIENT'S CATALOG NUMBER X
4. TITLE (and Subtitle) IS A CHANGE IN THE TACTICAL TRAINING OF MARINE CORPS ATTACK HELICOPTER PILOTS ESSENTIAL TO PERFORM THE ANTI-ARMOR MISSION.		5. TYPE OF REPORT & PERIOD COVERED 10 June 1977 Final Report.
7. AUTHOR(s) Major George A./Ross		6. PERFORMING ORG. REPORT NUMBER X
9. PERFORMING ORGANIZATION NAME AND ADDRESS Student of U.S. Army Command and General Staff College Ft. Leavenworth, Kansas 66027		8. CONTRACT OR GRANT NUMBER(s) X
11. CONTROLLING OFFICE NAME AND ADDRESS U.S. Army Command and General Staff College Attn: ATSW-SE Ft. Leavenworth, Kansas 66027		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS X
14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office) X		12. REPORT DATE 10 June 1977
15. SECURITY CLASS. (of this report) X		13. NUMBER OF PAGES 54
16. DISTRIBUTION STATEMENT (of this Report) Approved for public release; distribution unlimited.		15a. DECLASSIFICATION/DOWNGRADING SCHEDULE X
17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report) N.A.		
18. SUPPLEMENTARY NOTES Master of Military Art and Science (MMAS Thesis prepared at CGSC in partial fulfillment of the Master Program requirements.) U.S. Army Command and General Staff College, Ft. Leavenworth, Kansas 66027		
19. KEY WORDS (Continue on reverse side if necessary and identify by block number) X		
20. ABSTRACT (Continue on reverse side if necessary and identify by block number) This study attempts to determine the viability of current United States Marine Corps attack helicopter pilot tactical training. More specifically the researcher addresses only the anti-armor role of the attack helicopter. The investigation analyzes the threat of the Soviet Combined Arms Army. Current attack helicopter tactical training is analyzed in depth. U. S. Army, U. S. Marine Corps and Israeli Air Force tactical training		

DDC FILE COPY

AD A 043697

DD FORM 1 JAN 73 1473

EDITION OF 1 NOV 65 IS OBSOLETE

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

037 260

DDC
SEP 2 1977
RESERVED

1B

are compared to the threat, with mission accomplishment and survivability the key.

The investigation reveals a lack of adequate tactical training of U. S. Marine Corps attack helicopter pilots in the performance of the anti-armor mission. Proposed by the researcher are changes in the current tactical training program. These changes address involvement with a combined arms army and specifically the anti-armor mission of the attack helicopter. The training proposed will enable the attack helicopter pilot to survive the antiaircraft umbrella, the enemy fixed and rotary wing threat and accomplish his mission . . . destruction of enemy armor.

The tactical training specifically addressed are low level terrain flying which includes low level flights, contour flying and nap-of-the-earth flight and air to air tactics. "Around-the-clock" operations are discussed. Training must be both day and night, foul weather and fair. Emphasis is on realistic training with mission accomplishment as the end result.

IS A CHANGE IN THE TACTICAL TRAINING
OF MARINE CORPS ATTACK HELICOPTER
PILOTS ESSENTIAL TO PERFORM
THE ANTI-ARMOR MISSION

A thesis presented to the Faculty of the U.S. Army
Command and General Staff College in partial
fulfillment of the requirements for the
degree

MASTER OF MILITARY ART AND SCIENCE

by

G. A. ROSS, MAJ, USMC
B.S., Fairleigh Dickinson University, 1963
M.A., Pepperdine University, 1974

Fort Leavenworth, Kansas
1977

AD BELLUM

PACE PARATI

MASTER OF MILITARY ART AND SCIENCE

THESIS APPROVAL PAGE

Name of candidate Major G. A. Ross

Title of thesis Is A Change In The Tactical Training of Marine Corps
Attack Helicopter Pilots Essential to Perform the Anti-Armor Mission

Approved by:

William Loft Research Advisor

Michael R. Chaffin, Member, Graduate Faculty

Don Martin Jr., Member, Consulting Faculty

Accepted this 4th day of May 1977 by [Signature],
Director, Master of Military Art and Science.

The opinions and conclusions expressed herein are those of the individual student author and do not necessarily represent the views of either the U.S. Army Command and General Staff College or any other governmental agency. (References to this study should include the foregoing statement.)

ADDRESS	BY
DATE	DATE
DISSEMINATION/AVAILABILITY NOTES	DATE
A	

ABSTRACT

This study attempts to determine the viability of current United States Marine Corps attack helicopter pilot tactical training. More specifically the researcher addresses only the anti-armor role of the attack helicopter. The investigation analyzes the threat of the Soviet Combined Arms Army. Current attack helicopter tactical training is analyzed in depth. U. S. Army, U. S. Marine Corps and Israeli Air Force tactical training are specifically addressed. The aviation doctrines and tactics are compared to the threat, with mission accomplishment and survivability the key.

The investigation reveals a lack of adequate tactical training of U. S. Marine Corps attack helicopter pilots in the performance of the anti-armor mission. Proposed by the researcher are changes in the current tactical training program. These changes address involvement with a combined arms army and specifically the anti-armor mission of the attack helicopter. The training proposed will enable the attack helicopter pilot to survive the antiaircraft umbrella, the enemy fixed and rotary wing threat and accomplish his mission . . . destruction of enemy armor.

The tactical training specifically addressed are low level terrain flying which includes low level flights, contour flying and nap-of-the-earth flight and air to air tactics. "Around-the-clock" operations are discussed. Training must be both day and night, foul weather and fair. Emphasis is on realistic training with mission accomplishment as the end result.

TABLE OF CONTENTS

Chapter	Page
I. INTRODUCTION	1
Statement of the Problem	1
Questions to be Answered	1
Significance of the Problem.	2
Design of the Study.	3
Assumptions.	3
Limitations and Delimitations.	4
Definition of Terms.	4
II. REVIEW OF THE LITERATURE	6
The Threat	6
Current Marine Attack Helicopter Pilot Training.	13
U.S. Army Training and Evaluation.	15
Training for the Next War.	16
III. DESIGN OF THE STUDY.	24
IV. ANALYSIS OF THE INFORMATION.	27
What is the Threat That Confronts the Attack Helicopter Community?.	27
Is the Present Tactical Training Program Adequate?	30
What are the Training Considerations in View of the Known Threat?.	32
Discussion	36
V. SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS.	42
Summary.	42

Chapter	Page
Conclusions.	44
Recommendations.	45
CHAPTER II ENDNOTES	46
CHAPTER IV ENDNOTES	49
BIBLIOGRAPHY.	51

Chapter I

INTRODUCTION

Statement of the problem.

Is a change in the tactical training of Marine Corps attack helicopter pilots essential to perform the anti-armor mission?

Questions to be answered.

What is the threat that confronts the attack helicopter community? The dimension of warfare changed drastically during the October 1973 Arab-Israeli War. The potential enemy utilizes a highly effective combined arms army with a mobile air umbrella defense. In addition to the ground to air weaponry there appears to be the emergence of a new air to air threat, the Mi-24 "Hind" attack helicopter. Massive use of armor and mechanized infantry will require attack helicopters to assist in the destruction of the attacking force. Servicing these targets in a short time span will be a task of considerable magnitude.

The challenge for the pilot and his machine will be to destroy the armor targets in large quantities and survive the hostile environment.

Is the present tactical training program adequate? An analysis of the present tactical pilot training in view of the perceived threat will clearly demonstrate the adequacy or inadequacy of the training programs. The key is mission accomplishment and survivability. The pilot must have the skills which will permit employment and enhance survivability against the known threat. If the present tactical training is inadequate then new training considerations must be examined.

What are the training considerations in view of the known threat?

To answer this question, the attack mission must be examined. The mission, simply stated, is to engage and destroy enemy armor. There is also an unstated mission, survive to service additional armor targets. To accomplish this the pilot must evade or destroy the antiaircraft artillery and the attacking enemy aircraft, and then engage his target. To accomplish this mission certain skills will be required. These skills can be developed with an appropriate and realistic tactical training program.

This training will be developed from the following areas:

1. Nap-of-the-earth flight and navigation.
2. Low level terrain flight and navigation.
3. Night operations to include nap-of-the-earth, low level terrain flight and navigation.
4. Air to air engagements to include fixed wing and rotary wing.
5. Air to ground engagements from low altitudes, target identification and servicing.
6. Ground to air engagements, essentially defensive tactics against antiaircraft artillery, missiles and small arms.
7. Communications in a hostile electronic warfare environment.

Significance of the problem.

With the changing dimension of warfare and the commitment of the United States Marine Corps to readiness, the attack helicopter community must be prepared to fight the next war. There tends to be a penchant in the military community to prepare for the battle that has been fought, not the battle yet to be fought. Considering the threat which exists at the present time, training must prepare the attack helicopter pilot to meet and defeat that threat. Destroying enemy armor is the mission. The training must be realistic, honing the skills of the pilot to the highest

possible level of efficiency. Therefore the question is asked by the researcher, "Is a change in the tactical training of Marine Corps attack helicopter pilots essential to perform the anti-armor mission?"

Design of the study.

An in-depth examination will be made of the present threat, the combined arms army. Present Marine Corps attack helicopter training will be viewed. The question to be answered is whether this training is oriented towards present threat conditions? An extensive study will be made concerning current training requirements for the anti-armor role of the Marine attack helicopter community. This study will be centered on the current, most severe threat. Historical reference will be made to the October 1973 Arab-Israeli War. Additionally, the anticipated use of the Mi-24 "Hind" helicopter will be examined. The use of the attack helicopter in a hostile air and ground environment will be reviewed. Finally, the appropriate conclusions will be derived and presented. These conclusions will lead to recommendations for the training of Marine Corps attack helicopter pilots in the anti-armor mission.

The majority of the data will be gathered from professional journal articles. Both sides of the 1973 Arab-Israeli War will be reviewed. Current training standard operating procedures will be examined. Current data on helicopter aerial combat will be examined. Army attack helicopter training will be extensively examined as well as U.S. Army studies on the use of the attack helicopter in the anti-armor role.

Assumptions

The first and primary assumption is that the anti-armor role will be a primary mission of the Marine Corps attack helicopter community.

The second is that extensive training is required for Marine attack helicopter pilots to perform the anti-armor mission. The third and final assumption is that the combined arms army is the current worst case threat.

Limitations and delimitations.

This study is limited solely to the United States Marine Corps attack helicopter community. Further, examination will only be made of the anti-armor mission. Lastly, the combined arms army as employed by the Soviet Union will be the threat.

Definition of terms.

1. AAA - Antiaircraft artillery ranging from 12.7mm to 57mm.
2. ACM - Air combat maneuvering. The science and the art of air to air combat.
3. AGL - Above ground level. The height or actual altitude above the ground.
4. Air umbrella - The mobile air defense system as employed by the Soviet Union.
5. Attack helicopter - The U.S. Marine Corps AH1J or AH1T Sea Cobra. The USSR Mi-24 Hind A and B helicopter.
6. BRDM - Lightly armored, amphibious, wheeled vehicle.
7. Cobra - Synonymous with the AH1J or AH1T attack helicopter.
8. Combined arms army - The tactical military forces as employed by the Soviet Union. This is a highly mechanized and armored force coupled with massive artillery and air support.
9. Division - As referenced in this paper, a formation of (4) four aircraft consisting of the Division leader, his wingman, a section leader, and his wingman.
10. ECM - Electronic counter measures.
11. EW - Electronic warfare.
12. FEBA - Forward edge of the battle area.

13. Fixed Wing - Refers to all rigid wing aircraft.
14. Flight - More than one division of aircraft.
15. FLIR - Forward looking infrared.
16. IR - Infrared.
17. Low Level Terrain Flying - As referenced in this paper, all flights conducted below (50) fifty feet AGL. Air speed is constant and altitude is variable.
18. NOE - Nap-of-the-earth flight. All flights which use maskings techniques (terrain, foliage, trees, buildings) to remain concealed from the enemies detection devices. Airspeed and altitude are variable.
19. Rotary Wing - Refers to all rotating wing aircraft (helicopters).
20. SA - Small arms. Any weapon below the caliber of 12.7mm.
21. SAM - Surface to air missiles. USSR forces SA-2 through SA-9.
22. SEAD - Suppression of enemy air defenses.
23. Section - As referenced in this paper, (2) two aircraft consisting of a section leader and his wingman.
24. Service - A term meaning to destroy an enemy target.
25. TOW - Tube launched, optically tracked, wire-command link guided missile. Used to destroy armored targets.

Chapter II

REVIEW OF THE LITERATURE

The Threat.

The researcher will deal solely with the Combined Arms Army of the Soviet Union as the opposition force. General Creighton W. Abrams, former U.S. Army Chief of Staff, stated prior to his death:

The major military challenge to our global interests is the Soviet Union. It is the only other truly global military power. And so we must gage our ability to maintain freedom of action in terms of the Soviet Union, and in terms of the challenges that Soviet global interests and actions pose for us.¹

The Soviet conventional force is predominantly an armor/motorized force supported in depth by artillery. The air arm is oriented towards an air supremacy role and deep interdiction. The threat force thrusts forward quickly under the cover of surprise and an umbrella of a formidable anti-aircraft network. It pauses only long enough to consolidate ground gains and reposition anti-aircraft weapons before moving on to deep objectives in the exploitation phase. The main armaments consist of ballistic and missile systems with sophisticated night vision devices, computerized fire direction and radar guidance. Air defense consists of traditional radar and optically guided anti-aircraft guns, radar guided missiles, individually launched heat seekers and small arms fire. This anti-aircraft fire will be coordinated into sectors by altitude and by distance from the forward edge of the battle area (FEBA). Soviet doctrine stresses "around the clock" operations. They preach that decisive results can only be achieved through offensive action.

A discussion is necessary on Soviet employment doctrine and an examination of weapon systems. First, the Soviet Combined Arms Army. The main combat elements of the combined arms army are the motorized rifle division and the tank division. Usually this army will have a ratio of three or four motorized rifle divisions to one tank division.² Organic to this army will be an artillery brigade, a surface to surface missile brigade, a surface to air missile regiment and other essential support elements such as engineers, signal, chemical, motor transport and bridge units. Soviet tactics call for echelonment of the attacking forces. The combined arms army will normally attack in two echelons, the first echelon consisting of (2) motorized divisions will have a breakthrough zone of 20 to 30 kilometers. The second echelon consists of the remaining divisions usually 15 to 30 kilometers to the rear of the first echelon. If there is more than one tank division in the army it may be assigned as the exploitation force. Concentration of forces on a narrow front is typical. A division will normally attempt a breakthrough on a 4 to 8 kilometer front. This concentration of armored units presents massive problems to the opposition force. A defending company could expect to engage about (60) tanks in a 10 to 15 minute time frame. This fact can easily be computed by recognizing that the Soviet tank division consists of (325) tanks. The breakdown is (95) tanks per regiment and (31) tanks per battalion. The concentration on a narrow front can give the Soviet a 6 to 1 advantage, therefore the defending company can expect to engage (2) battalions. The time frame is also fairly easy to compute. The maximum effective range of a defender's weapon is about 3000 meters. The (2) attacking battalions can close this range in about 10 to 15 minutes.

Artillery is the next consideration. Here the Soviets believe in massing artillery fires to influence the course of battle. Each division

has an artillery regiment. The motorized rifle division has (38) 122mm howitzers and (18) 152mm howitzers; the tank division has (54) 122mm howitzers. Additionally each division has a multiple rocket launcher battalion consisting of (24) 122mm multiple rocket launchers and a FROG battalion consisting of (4) FROG launchers. The combined arms army will normally weight the main effort with additional artillery, normally consisting of 152mm howitzers and 130mm guns. Doctrinally this artillery will be deployed well forward, with the divisional artillery being 4 to 6 kilometers behind the FEBA and the regimental artillery being $\frac{1}{2}$ to 4 kilometers behind the FEBA.³ It can be anticipated in a swift moving operation 1/3 of the artillery will be displacing at all times.

The antiaircraft umbrella of the Soviet forces reigns supreme among the nations of the world. Soviet doctrine stresses mass - a concentration of weapons, mix - employment of complimentary weapons, mobility - all air defense weapons are capable of keeping up with and maintaining air defense coverage for the maneuver forces, and integration - air defense weapons are integrated with the commanders scheme of maneuver. All units are oriented toward air defense. All personnel are trained to recognize, engage, and report all opposition aviation forces. The infantry engage all targets with the SA-7 IR missile and small arms consisting of the 7.62mm machine gun, the 12.7mm machine gun and the 14.5mm gun. The latter two of these weapons are vehicle mounted or on a quad mounted carriage. Each division has an antiaircraft regiment consisting of (16) SA-8 missile launchers. At the regimental level each regiment has an antiaircraft battalion consisting of (8) SA-9 missile launchers and (8) ZSU-23-4 anti-aircraft gun systems. The army will support the attacking divisions with SA-6 missile units. Additionally, the army will provide cover for its division with the less mobile SA-2, SA-3, and SA-4 missile systems.⁴

Since penetration of this air defense system will be necessary for the attack helicopter to perform the anti-armor mission, the researcher will present an in-depth analysis of this formidable system. Much of what is known about the Soviet air defense umbrella was derived from the 1973 Arab-Israeli conflict. In the first afternoon engagement over the Golan, Israel lost (30) A-4 Skyhawks and about (10) F-4 Phantoms to the SA-6 and the ZSU-23-4 antiaircraft batteries.⁵ Over the next week Israel lost over (80) aircraft on both fronts, the vast majority were downed by the SA-6 and the ZSU-23-4. By the end of the conflict Israel claimed that only (4) of the (115) aircraft lost were downed in air to air engagements.⁶ Israeli pilots were engaged by massive numbers of SA-7 missiles. Salvos of (8) to (10) missiles were noted. A large unknown is the number of SA-7 missiles at the divisional level. In the 1973 war, Egypt provided its lead armies (2nd and 3rd) with massive numbers of SA-7 missiles.⁷ Egyptian reasoning on employment of the air defense umbrella was that this system could nullify the superior Israeli Air-force.⁸ The system proved extremely effective. However, once the Egyptian forces moved from the cover of this umbrella they fell easy prey to Israeli air strikes consisting of fixed wing and helicopter-borne missiles.⁹ The Israelis noted this shortcoming in a statement by Lt. Gen. David Elazar.

The Arab Armies used Soviet equipment according to the Soviet doctrine, but the standard of their efficiency was far from what is expected by the Soviets in the operation of their equipment.¹⁰

It is anticipated that the Soviet force will not outrun its air defense cover.

To appreciate the air defense umbrella it is necessary to examine each weapon. Starting at the infantry level, large numbers of individually fired SA-7 "Strela" missiles proliferate the battlefield. The SA-7 is an

IR, shoulder fired, missile with a range of 3.5 kilometers. It is comparable to the U.S. "Redeye." The 7.62mm machine gun will also be employed at this level. It has a cyclic rate of fire of (650) rounds per minute and an effective range of 1000 meters. When operating in the vicinity of the FEBA frequent engagement by these man-portable weapons can be expected. The next level of the air defense umbrella is the low to medium altitude air defense system. These weapons are found at divisional level. They consist of the SA-6 "Gainful," a track mounted radar/IR guided missile with (3) launchers per vehicle. The SA-6 has a range of 30-35 kilometers. The SA-8 is mounted on an amphibious vehicle, (2) launchers per vehicle and is capable of launching (2) missiles simultaneously. This missile is radar guided and has a low level light T.V. capability. The system is completely self contained and has a range of 15 kilometers. The SA-9 system consists of (4) missile launchers mounted on a "BRDM" amphibious vehicle. It is IR guided and has a low level light T.V. capability. The range of this missile is 7 kilometers. This system mutually supports the ZSU-23-4 gun system and is completely self contained. The ZSU-23-4 gun system is a track mounted, quad barreled 23mm gun system. It has an effective rate of fire of (800-1000) rounds per minute per gun. The system is both radar and optically guided with a range of 3000 meters in the radar mode and a range of 2,500 meters in the optical mode. This system is also self contained. The ZSU-57-2 is a track mounted (2) barreled 57mm gun. The effective rate of fire is (105-120) rounds per minute per gun. It is optically guided and has an effective range of 4000 meters. This gun system is being phased out of Soviet forces. The ZPU-4 is a quad barreled 14.5mm gun mounted on a towed carriage. It has an effective rate of fire of (600-700) rounds per minute per gun and an effective range of

1400 meters. This is an optically guided gun. The 12.7mm machine gun comes in a variety of configurations. It is commonly found on all tracked and amphibious vehicles. There is also a dual and quad mounted system on a towed carriage. It has an effective rate of fire of (500-700) rounds per minute per gun and an effective range of 1000 meters. The low to medium air defense system seriously restricts the close to the FEBA employment of all aircraft not operating in a terrain flight mode. The final band of air defense is the high to medium altitude air defense system. It is highly unlikely that these systems would be used to engage attack helicopters. The systems found here are the SA-2 "Guideline", the SA-3 "GOA", and the SA-4 "Ganef". These are all radar guided with ranges of 24 to 70 kilometers. Any aircraft flying 1000 feet above the ground level (AGL) or higher could be engaged by these systems.¹¹ The individual weapons appear quite formidable but it is the mutual support which is the key to their lethality. The long range SA-3 and SA-4 system covers the outer zone up to about 70 kilometers. Then moving into the more mobile weapons, the SA-6 covers from the 5 to 30 kilometer range. This system is integrated with the SA-8 which is completely self contained and can range up to 15 kilometers. The SA-9, SA-7 and the ZSU-23-4 interlock for extremely close in air defense ranging from 7 kilometers to the devastating fire from the 23mm guns.¹² All air defense systems are totally dependent on acquisition. The Soviets rely upon a multiple system alert network. They have sophisticated radars which can detect an aircraft within about two seconds and lock on and fire within 9 seconds.¹³ Coupled with the radars are optical devices and the human eye. Soviet personnel are oriented toward aircraft look out doctrine. They identify, engage and communicate the presence of enemy air assets. The attack helicopter crew must anticipate that if engaged by infantry the air defense network

has been alerted. These assets are closely integrated with maneuver units. As stated, the air defense arm is highly mobile and will be deployed in an over watching position, leap frogging ahead of or moving among the maneuver units.

The next area examined is the air arm of this highly functional force. To be sure, the Soviets present a formidable air threat. Their inventory of weapons consists of highly sophisticated fighter and attack aircraft, all of which pose a threat to the attack helicopter. These fixed wing aircraft carry a full range of weapons which can be employed effectively against helo-borne forces. However, potentially the most dangerous threat is the Soviet attack helicopter. Specifically, the Mi-24 "Hind" aircraft. No longer can the possibility of helicopter versus helicopter aerial combat be ignored. The Mi-24 is a unique attack helicopter. It carries a full array of weapons: rockets, antitank missiles, a 12.7mm gun or a 23mm turret mounted cannon and a combat infantry squad of 8 to 12 men. It has retractable landing gear with a cruise speed of 140 kts. and a top speed in excess of 160 kts.¹⁴ The "Hind" is employed in the anti-armor role, but there is growing concern about its anti-helicopter capabilities.¹⁵ It is well within the state of the art to mount IR missiles on this helicopter as well as a sophisticated radar gunsight. The researcher will consider the anti-helicopter role of this aircraft as a major threat.

Lastly, the researcher will present the electronic warfare capability of Soviet forces. The combined arms army uses extensive jamming in support of air defense operations and ground operations. Electronic reconnaissance is extensively used to detect and locate enemy units. Once again the 1973 Middle East War can illustrate the EW capabilities.

Arab forces used direction finding of Israeli radio transmissions for targeting. Jamming was extensively used to disrupt command and fire direction nets. The air defense tracking and guidance radars were able to rapidly change frequencies to overcome Israeli jamming. It is well within the Soviet's capability to substantially disrupt battlefield communications thereby rendering many command and fire direction nets ineffectual. Voice communications have long been considered essential to military aviation. The massive EW capabilities of the Soviets may well modify this requirement. Truly the days of clear text radio transmissions are over, and voice communications are rapidly becoming a luxury of the past.

Current Marine attack helicopter pilot training.

The current training program for Marine Attack Helicopter Pilots is performed solely at the squadron level. The pilots enter this program from three basic areas. First, the aviator recently graduated from Naval Flight Training. He is considered a basic trainee. Next is the transition pilot. He is an experienced Naval aviator who has been flying another type of aircraft and is transitioning into the attack helicopter community. Lastly is the refresher pilot. He has been qualified in the attack helicopter community but has been in a non-flying billet and must be re-familiarized with the attack helicopter. For the purposes of this research the attack helicopter is the AH1J aircraft or "Cobra." Additionally, for this research only the basic and the transition pilot syllabus will be considered. This syllabus covers the full spectrum of tactical squadron level training. The training syllabus is broken down into three major areas: flight simulator training, squadron level training and flight training. This study will concentrate on the flight training phase.

There are four major sub-groups in the flight program: combat capable training, combat ready training, combat qualification training, and full combat qualification training. In the combat capable training there are (38) sorties for a total of 71.5 flight hours.¹⁶ This phase is the basic stage. Concentration in this phase is on fundamentals consisting of familiarization, instrument, night, navigation, formation, visual reconnaissance, visual ordinance, basic tactics, and, finally, a check flight. In this stage a total of (3) sorties consisting of 6 flight hours are involved with low level flying and navigation.¹⁷ No nap-of-the-earth (NOE) training is conducted in this phase. Combat ready training consists of (13) sorties for a total of 21 flight hours. This phase is concerned with tactical instrument flight, visual ordinance, advanced navigation and supporting arms coordination.¹⁸ In this phase, (2) sorties for a total of 3 flight hours are involved with low level navigation.¹⁹ No NOE training is conducted during this phase. The combat qualification training stage consists of (15) sorties for a total of 26 flight hours. This phase consists of armed escort, advanced visual ordinance, advanced tactics, advanced instrument flight and the attack helicopter commander flight check.²⁰ This phase has (3) sorties for a total of 4.5 flight hours involving low level flight training. One sortie is devoted to NOE flight.²¹ The final phase of training is the full combat qualification stage. This syllabus consists of (21) sorties for a total of 29.5 flight hours. The training consists of advanced visual ordinance, advanced supporting arms coordination, field carrier landing practice, carrier qualifications, and mountain area training.²² There are no sorties involving low level or NOE flight. There is presently a proposed change to the training and readiness manual which would add (3) low level sorties to the syllabus. Also included in this proposal are (4) sorties involving

air to air engagements, (2) sorties for helicopter versus helicopter and (2) sorties for helicopter versus fixed wing.²³ The Marine Corps is anticipating the arrival of the AHIT "TOW Cobra" early in calendar year 1977. However, to date no anti-armor training has been addressed by the community. No emphasis has been placed on tactics involving the anti-armor mission. Further, no formal consideration has been given to involvement with a Soviet force. Under certain conditions the attack helicopter may be the only aviation asset available to perform the anti-armor mission. Training to accomplish this mission is essential.

U.S. Army training and evaluation.

The U.S. Army has approached the employment of the attack helicopter from a realistic understanding of present battlefield conditions. The October 1973 Arab-Israeli Conflict clearly demonstrated that long range, high velocity tank cannon and long range anti-armor missile systems dominate the modern battlefield. Additionally, the air defense umbrella can control the air above the battlefield. "What can be seen can be hit - what can be hit can be killed."²⁴ To defeat a Soviet force, U.S. forces must find the enemy first, outmaneuver the enemy and kill him on a ratio of at least five to one. The attack helicopter provides a weapons system which can measurably increase the kill ratio. The following is an extract which depicts the efficiency level required of a U.S. Army Attack Helicopter Battalion. The battalion is to engage a Soviet motorized rifle division. This division has been forced to break contact and withdraw to a defensive position. The division is capable of monitoring and jamming all radio transmissions. Lower limits of early/warning acquisition radar coverage is about 100 feet above the highest terrain. All air space above 100 feet (AGL) is within the SAM kill zone. The Soviet division has SA-7,

SA-8, SA-9 and ZSU-23-4 air defense weapons. All enemy armor has a 12.7mm machinegun antiaircraft weapon mounted. To receive a satisfactory rating the attack helicopter battalion must move promptly into contact, effectively rotate attack assets to keep up continuous contact, coordinate and employ all available firepower once the enemy division is engaged. Operational security will be maintained throughout the operation. This exercise must be accomplished under both day and night conditions.²⁵ Truly this is a realistic scenario. Unique and innovative training must be utilized to accomplish the mission.

Training for the next war.

The key in developing appropriate training is the assessment of the threat or opposition force and then applying that assessment to tactical situations. Considering the Soviet force structure and doctrine,

it should become readily apparent that the way we employed our aviation assets in the Republic of Vietnam simply won't cut it on the mid-intensity battlefield. We must operate around the clock, on the deck, and this must be more than the current lip service we pay to this capability.²⁶

Categories of training will be introduced with total emphasis on the anti-armor mission. Survival flying within the range of the Soviet air defense umbrella dictates specific tactics. The flight regimes will be one of low level, contour or low level terrain, and nap-of-the-earth. A brief explanation of terms is necessary. Low level is considered high speed with airspeed being held constant at a constant altitude. Contour or low level terrain flying is high speed with airspeed being held constant and the altitude being dictated by the contour of the ground. In either low level or contour flying the maximum altitude above the ground should be 100 feet, preferably lower in contour flying. The last flight regime is nap-of-the-earth. NOE flight is characterized by varying airspeed and

altitude utilizing masking techniques to the maximum. The best description of NOE is "a low crawl." Since the Soviets preach "around the clock" operations the aforementioned flight regimes must be executed both day and night, foul weather and fair. This type of training must commence at all levels starting with initial flight training and expanding throughout the training syllabus at the squadron levels. The "doubting Thomases" will decry the safety aspect of this program. However, if executed in a highly controlled environment the safety record can be maintained at an acceptable level. The crux of the matter is whether we want a trained, effective force which can survive on the mid-intensity battlefield and perform its mission or an extremely expensive static display. "Marine leaders must be as realistic about training helicopter crews as they are in training the fixed wing crews."²⁷

The training should progress on a logical basis, phasing from low level through contour to nap-of-the-earth. With the exception of the initial familiarization phase, initial gunnery phase, carrier qualification and instrument training, all flight training should be conducted in the low altitude flight regime. During the initial phase extensive map reading and terrain interpretation is essential. Navigation must be accurate so the aviator can fly within a corridor 100 meters wide and still give his location in six digit coordinates at any time. Extensive use should be made of aerial photographs.²⁸ Tactics must also be studied in-depth. Thorough knowledge of friendly and enemy tactics is essential for survival and provide a fine blend and integration of the air ground team. All low level, contour and NOE routes must be flown by experienced crews prior to actual training, noting all hazardous areas. Hazard maps must be compiled and updated continuously. Proper command and control is achieved by having a command and control aircraft overfly the route at an altitude of

500 to 1000 feet to observe and oversee the NOE aircraft. The routes must be realistic with little emphasis on man made objects. It should be designed to use natural terrain features. All level unit commanders, squadron, group and wing must become deeply involved to reinforce the low altitude programs. They should fly both command and control and NOE to reinforce the training and to get a better appreciation of the problems associated with low altitude flight.²⁹ Once day low altitude flight is mastered the more precise area of night low altitude flight must be learned. "One hour of night NOE may be equivalent to five or six hours of normal daytime point A to point B high altitude work."³⁰ NOE night altitude should be tied to the threat and the light level. The three basic night light levels are low light level, corresponding to no moon; mid light level, corresponding to a partial moon; and high light level, corresponding to a quarter moon at its zenith or a full moon after it has risen over the horizon. Interestingly enough, the darker the night the lower the pilot flies NOE.³¹ A command and control aircraft is absolutely necessary for all night training. "Night NOE requires experienced crews. The U.S. Army Night Hawk Training Test recommended no crew member with less than 500 flight hours engage in night NOE."³² It is going to require a very precise and exacting program to develop the type of flight crews that will be capable of mission accomplishment. NOE flight, both day and night, is a very exacting task. The crew demands are high. Division of the work load is necessary between the pilot and co-pilot/navigator/gunner. Inter-cockpit coordination is an absolute necessity.³³ Because of the crew demands in NOE flight "the maximum time spent on any training flight should not exceed 1.5 hours. The stress of NOE flying is a big factor in safety."³⁴ Low altitude flight is equally hard on the machine. Aircraft fuel consumption rates are high. Lift capability is decreased due to the hovering

out of ground effect requirements. Engines are running at high power settings for extended periods of time. Finally, the probability of blade strikes is increased due to the operating environment. These factors must be considered; this is by no means a casual flight program.

The next aspect of training to be discussed is that of air to air tactics. This is an area that has long been ignored, but there is a threat from both fixed and rotary wing Soviet assets. The Israeli Air Force is presently training both fixed wing and rotary wing crews in this area. Israeli helicopter pilots are trained in techniques to be used when attacked by fighter aircraft. During combat, Israeli helicopter pilots kept constantly abreast of the fighter situation in their sector by monitoring the radio. When attacked by fighters the tactic devised was to turn into the attacking aircraft and climb. As the range closed the helicopter entered an autorotation. This forced the attacker to steepen his dive angle to gain a sight picture. Because these maneuvers occur at low altitude, the attacker can achieve a lock on for only a short time and must abort the run or crash. The helicopter must never present its flank. The Israeli pilots train in these evasive tactics by practicing against jet aircraft. Sustained attacks by more than one aircraft would probably defeat the autorotation tactic. In this case a turn towards the attacker is essential keeping the nose of the helicopter pointed at the attacker. Coupling this maneuver with NOE in an attempt to use cover and concealment is a highly effective technique. Visual contact must be maintained with the attacker at all times.³⁵ The U.S. Army/Hunter-Liggett tests concluded exactly what the Israeli Air Force has been practicing.³⁶

The attack helicopter with its flexible weapons is a logical helicopter killer. Attack helicopter formations will be vulnerable to attack by enemy air elements while marshalling, moving to the attack, during the attack, and retiring.

Continuous defensive tactics are necessary to offset an enemy air attack.³⁷

There is very little practical experience in the area of helicopter versus helicopter tactics. There is however, current U.S. fighter doctrine which is applicable. These might be considered the "Ten Commandments" of aerial combat.

1. Know your weapons system - know the characteristics of the aircraft weapons system, know their effective ranges.
2. Know your aircraft - know the limitations of your aircraft and your ability to fly your aircraft to its maximum capabilities.
3. Know the enemy - know the enemy aircrafts performance, weapons and tactics. Know the enemies weaknesses. One such weakness is the lack of self sealing fuel cells on all Russian helicopters. Vulnerable spots must be identified and used as aiming points. If vulnerable spots are unknown the enemy pilot should be used as an aiming point.
4. Plan thoroughly - pre-flight planning determines the success or failure of a mission.
5. Use proper movement techniques - helicopters flying NOE can more effectively accomplish their mission if they employ armor and mechanized infantry overwatching movement techniques.
6. Use the sun to your advantage - whenever possible position yourself so the sun will be at your back. Shadows caused by the sun can conceal a helicopter.
7. See the enemy first - constant vigilance is required for survival. Seeing the enemy first is essential.
8. Inform others - when the enemy is spotted give his identification, location, and your intentions.
9. Fight to win and survive - the formula used by many aces was clear yourself, close with the enemy, and shoot well.
10. Be aggressive - when in doubt attack. The one who fires first usually wins the engagement.³⁸

The need for this type of training has already been identified by the U.S. Army in TC 17-37-1. However, the tactics leave much to be desired.³⁹

The Marine Corps has recognized the problem and this recognition has been expanded upon in the proposed changes to the Training and Readiness Manual dated 30 June 1976. This change proposes the addition of (4)

sorties of air to air tactics in the Full Combat Qualification Training phase.⁴⁰ More important, however, is a change in doctrine and tactics. The concept of helicopter engagements should change from solely the defensive role to both defensive and offensive tactics.

The primary mission of the AHIT "Sea Cobra" is the destruction of enemy armor forces. To quote a phrase this is where "the rubber meets the road." The engagements will be quick and violent and will utilize NOE techniques, ambushes and rapid movement. Heavy antiaircraft fire and artillery fire will greet any exposed "Cobra." Communications between aircraft and to ground units will be degraded due to low altitude flying and to enemy electronic warfare activities. Radio silence may well be the rule rather than the exception.

The ultimate goal of every attack helicopter crew must be to hit the target with the first round or bursts and destroy it with a minimum expenditure of ammunition and exposure. Air crews must be able to shoot while flying at low altitudes on the battlefield.⁴¹

The U.S. Army tested NOE techniques against an armor force in Ansbach, Germany. The tactics used gave the attack helo's a 28 to 1 kill ratio.⁴² In the U.S. Army "Reforger 74" exercise, using NOE techniques and flying with teams consisting of (1) scout and (2) attack ships, outstanding results were noted. During a 4½ day time period the attack helicopters accounted for (200) tanks, (6) helicopters, (2) fixed wing aircraft, assorted trucks and light vehicles while losing (4) aircraft, (2) of which were scouts. Additionally, and most important, the attack teams were able to fly when fixed wing aircraft were incapable of performing their mission due to weather.⁴³ In a European scenario there are certain times when fixed wing aircraft cannot fly due to weather constraints; this may be as much as 50% of the time.⁴⁴ This refers specifically to target (tank) acquisition with cloud ceilings below 500 feet and visibility

less than 1 mile. An attack helicopter utilizing low altitude flight techniques can fly under these conditions.

In 1972, the 1st Combat Aerial TOW Team of the 155th Aviation Company was formed. The experiment viewed the capabilities of various radars, infrared and visual ground to air systems against the aerial TOW Team. This experiment was divided into three phases.

Phase I consisted of low altitude training, NOE techniques, sneak and peek tactics, and engagements at maximum ranges. Phase II was a free play, realtime, casualty assessment exercise. A team consisting of (1) Scout and (2) attack helicopters was pitted against a medium tank company with air defense weapons. The team consistently engaged the armor at long stand-off ranges with a favorable kill ratio. In Phase III (1) team deployed to the Republic of Vietnam and (1) team deployed to Europe to operate in a joint Canadian, West German and American exercise. The European results were a kill ratio in excess of 16 to 1 in favor of the attack helicopter. In the Republic of Vietnam the team destroyed 24 tanks, both PT-76's and T-54's, without the loss of any crews or helicopters. The time frame was 10 May 1972 until 12 June 1972. On 10 May 1972, ten tanks were destroyed without any helicopter sustaining a hit.⁴⁵

Low level altitude flying is essential for survival, but it is also essential for mission accomplishment. In the mid intensity threat more emphasis is needed on small aircraft formations to penetrate the FEBA, massing only at a predetermined point to engage the armor. The FEBA can be penetrated by infiltration techniques. Utilizing the best terrain possible each aircraft penetrates the FEBA with about (2) kilometers lateral separation. Each crew flies its own route to a rendezvous point where join up is possible. Phase lines and boundaries are used to ensure that each aircraft maintains proper alignment. A negative approach to communication

is utilized to maintain the element of surprise. This type of flying is possible with weather ceilings of 100 feet and visibility of 1 mile.⁴⁶

At NOE altitude there is only momentary observation of the target. This does not allow sufficient time to evaluate it for complete description. The range to the horizon is about 1,000 meters. Over vegetative terrain NOE altitude may allow only 500 meters maximum width in the field of vision. Large size targets such as tank and self-propelled guns can be identified reliably in clutter up to a maximum range of 900 meters with the unassisted eye. Smaller targets such as troops can be identified up to about 300 meters. Familiarization with the outline, shape or form of objects will facilitate detection. Detailed vision of parts of an object may also disclose a target.

The essential tactics, flight regimes, navigation, target identification, and target kills are possible with an intensive training program. This training must be oriented toward the war we will fight, not the war we just fought. Re-evaluation of the Attack Helicopter Crews Training and Readiness Manual is necessary. The Marine Corps is and always will be mission oriented; realistic training is essential to perform the mission successfully.

Chapter III

DESIGN OF THE STUDY

The research methodology utilized by the writer is solely historical in nature. All data has previously been compiled and, as such, is historical.

This information was derived from a variety of sources. The United States Army Command and General Staff College provided the bulk of the data concerning the threat forces. This data was derived from the Threats Division at the College. They also were instrumental in providing U.S. Army Field Manuals describing assault helicopter operations, readiness and training requirements, and a general overview of attack helicopter doctrine and tactics. The data concerning current United States Marine Corps Attack Helicopter Training was provided by three major sources. The Training and Readiness Manuals were provided by HMA-169, Camp Pendleton, California, and HMA-269, Marine Corps Air Station, New River, North Carolina. The proposed changes to the Training and Readiness Manuals were provided by HMA-169, Camp Pendleton, California, and MAWTUPAC, Marine Corps Air Station, El Toro, California. Further information on techniques was provided by the Naval Air Test Center, Rotary Wing Aircraft Test Directorate, Patuxent River, Maryland. The remaining articles were gathered from the libraries of the United States Army Command and General Staff College and the United States Air Force Academy.

The data base is totally historical in that all data is contained in existing literature. The doctrine and the tactics are those utilized

by the United States Marine Corps, the United States Army, the United States Air Force and the Israeli Air Force. A mixture or blend of doctrine and tactics is also addressed.

The topic has been selected because the United States Marine Corps is committed to the acceptance of the AH1T "TOW Cobra." This aircraft is specifically designed as an anti-armor system. Under current training techniques mission accomplishment appears to be doubtful. The United States Marine Corps is a mission oriented force. As such, it is essential that it be able to defeat an armor threat as posed by Soviet Forces. With realistic training the AH1T "TOW Cobra" is an excellent weapon system which can measurably contribute to mission accomplishment.

The following questions will be answered by the researcher. Is a change in the tactical training of Marine Corps attack helicopter pilots essential to perform the anti-armor mission? What is the threat that confronts the attack helicopter community? Is the present tactical training program adequate? What are the training considerations in view of the known threat? The last three questions, when answered, will provide the solution to the initial question, Is a change in the tactical training of Marine Corps attack helicopter pilots essential to perform the anti-armor mission?

All data collected has been recorded in the bibliography and referenced in chapter endnotes. As previously described, the major contributors provided a vast array of data concerning specific topics. This information concerned the threat, current training, doctrine, and tactics. The bulk of the data was derived from professional journals, field manuals, scientific or aerospace journals, individual studies, tests, exercises and historical writings.

The methodology results from empirical sources in the sense that all data has been drawn from other sources or research. The researcher is not aware of any previous study in this specific area.

This study is limited solely to the adequacy of tactical training in the United States Marine Corps attack helicopter community. Further, examination will only be made of the accomplishment of the anti-armor mission. Lastly, the combined arms army as employed by the Soviet Union will be the threat.

An overview of this thesis shows it to be historical in nature. Information has been gathered which depicts the threat as the Soviet Combined Arms Army. This force has been examined in detail, depicting its major maneuver elements, its supporting artillery, air defense and air forces. Current 1976 Marine Corps Attack Helicopter Training has been examined. This training appears to be lacking in mission accomplishment. Current doctrine and tactics of U.S. and Israeli assault helicopter forces have been examined. Further examination of air to air tactics has been reviewed. It is becoming readily apparent that a change in doctrine and tactics is essential.

Chapter IV

ANALYSIS OF THE INFORMATION

What is the threat that confronts the attack helicopter community?

The researcher has classified this threat as a combined arms army as employed by the Soviet Union.

In general the ground forces of the Soviet Union are estimated at about 1.7 million men. Their antiaircraft forces, assigned to the defense of the skies over the Soviet Union and above any Soviet formation, wherever it may be, are estimated to amount to something like 250,000 men. The total ground force is comprised of about 164 to 166 divisions. They are divided into 100 mechanized infantry divisions, or about 60% of the whole force; about 54 armored divisions, 30% of the force; about 12 airborne divisions, roughly 7% of the force; and 3% of special units, commandos and other formations. Thirty-one of these divisions are in Europe, something between 85 to 86 in European Russia, and about 49 divisions facing China.¹

The European forces are elite divisions belonging to the 3rd Shock Army located near Magdeburg, the 8th Guards Army in the Weimar area, the 20th Guards Army in Eberswalde district, the 2nd Guards Army southeast of Berlin near Furstenberg and the 1st Guards Tank Army in the Dresden area. All Soviet European forces are kept at the highest level of preparedness and receive the most modern equipment.² These are Soviet forces; added to these are the ground and air divisions of the Eastern Bloc and Warsaw Pact Nations.

The typical Soviet model of a combined arms army will have the following array of antiaircraft defenses:

- (19) AA batteries of ZSU-23-2 guns.
- (32) AA batteries of ZSU-23-4 guns.
- (6) AA batteries of ZSU-57-2 guns.
- (23) AA batteries of S-60 (57mm) guns.

- (5) SAM batteries of SA-6 (Straight Flush radar).
 - (9) SAM batteries of SA-4 (Pat Hand radar).
 - (3) SAM batteries of SA-2 (Fan Song radar).
- Also, Flat Face and Long Track radar for long-range reconnaissance.³

Their doctrine calls for concentration of fire power. Tactically these weapon systems will be integrated into the ground forces and will at all times be mutually supporting. Additional air defense weapons will consist of SA-7 "Strela" quantity unknown, and SA-8 and SA-9 quantity unknown. All vehicles will mount either a 12.7mm machinegun or a 14.5mm gun. "The Soviets have progressed to the point of spectrum siting of co-deployed weapons systems, often having as many as five major systems deployed at one site."⁴

Coupled with this mobile air defense umbrella will be the full array of Soviet field artillery and aviation assets. The combined arms army uses massed artillery fires providing rolling barrages just forward of the advancing mechanized infantry and armor units. During a swift moving operation one-third of the artillery will be displacing at all times. At present the majority of this artillery is towed; however, recently self-propelled 122mm and 152mm artillery have been observed. Certainly a portion of these artillery fires will be directed at suspected helicopter ambush sites or in areas where helicopter activity has been noted. The quantity of artillery in the combined arms army far surpasses western counterpart forces. The typical combined arms army division will have from (54) to (56) 122mm and 152mm howitzers as well as (24) 122mm multiple rocket launchers. This organic artillery will be augmented by 152mm howitzers and 130mm guns from army level assets. All artillery is typically located well forward with the regimental artillery located $\frac{1}{2}$ to 4 kilometers behind the FEBA and the divisional artillery located 4 to 6 kilometers behind the FEBA.⁵

Aviation assets will also be available to ground forces. The Soviet fighter force is modern and carries the full spectrum of airborne ordnance. Doctrinally, the Soviets consider air strikes as an extension of artillery and devote great emphasis in tactical air support of ground operations to attacks against preplanned targets. In order of priority these targets are: tactical nuclear delivery systems, control posts, command and communication elements, and neutralization of artillery support and reserves within the tactical and immediate operational depths. Soviet aviation does not normally utilize high performance aircraft to provide close air support along the FEBA.⁶ A major threat to the attack helicopter may be the Mi-24 "Hind" helicopter. It is equipped with rockets, anti-tank missiles, a 12.7mm gun or a 23mm turret mounted cannon and it can carry a combat infantry squad of 8 to 12 men. It can cruise at 140 kts. and has a top speed in excess of 160 kts.⁷ The potential as an anti-helicopter helicopter is tremendous. It is well within the state of the art to mount air to air missiles and install radar and lead computing gunsights.

The combined arms army employs electronic warfare with extensive capability to disrupt battlefield communications. The division doctrinally uses electronic counter measure (ECM) to neutralize enemy communications and electronics through jamming or deception.⁸ Electronic warfare units are assigned to the army with the capability to conduct radio and radar intercepts, direction finding and communications jamming.

The threat is well defined. However, to be a "force in readiness" all challenges must be conquerable. If the Marine Corps can be successfully employed against the most severe threat then the "force in readiness" is a viable concept.

The Soviets preach "around the clock" operations and well recognize the U.S. reliance on an active air arm. To counter this capability they have developed the most sophisticated air defense umbrella ever conceived. They also have characteristically launched major offensives in poor weather conditions. The weather conditions in Europe can preclude the optimum utilization of fixed wing aircraft as much as 50% of the time.⁹ The attack helicopter can offer a viable alternative under these conditions as well as a complimentary system to fixed wing under fair weather conditions. The optimum employment to blunt an armor attack, as well as to launch an offensive, will be one of combined arms. Utilization of all assets in a united effort will be the most successful. The marrying together of fixed wing, rotary wing, artillery, direct fire, and infantry as well as optimum use of electronic warfare can dominate the battlefield.

Is the present tactical training program adequate?

A review of the present and proposed tactical training has been conducted. The researcher found that currently all tactical training is accomplished at the squadron level. The syllabus studied was the basic and transition pilot program. This was selected because it covered all phases of training and it was the most in-depth training syllabus. Further, only the flight training phases were examined. The flight programs were broken down into four major sub-groups: combat capable training, combat ready training, combat qualification training, and full combat qualification training. Each major sub-group was examined for type of training, number of sorties, flight hours and percentage of overall training qualification. The combat capable training (initial training) consists of (38) sorties, 71.5 flight hours, and represents 60% of the pilots overall

training. In this phase a total of (3) sorties consisting of 6 flight hours are involved with low level flying and navigation, less than 1% of the phase. No NOE training is conducted in this phase. The combat ready stage consists of (13) sorties, 21 flight hours and comprises 10% of the training syllabus. In this stage (2) sorties for a total of 3 flight hours are involved with low level navigation, less than 2% of the stage. The combat qualification training consists of (15) sorties, 26 flight hours and comprises 15% of the aviators total tactical training. This phase has (3) sorties for a total of 4.5 flight hours involving low level flight training; one of these sorties is devoted to NOE flight. In this stage 2% of the training involves low level flight. The full combat qualification training stage consists of (21) sorties, 29.5 flight hours, and is 15% of the tactical training syllabus. There are no low level or NOE flights conducted in this phase. The total syllabus consists of (87) sorties, 148 flight hours with a total of (8) sorties devoted to low level flight, navigation and NOE flight.¹⁰ Less than 1% of the training syllabus is devoted to a tactic which enables the attack helicopter to perform the anti-armor mission.

A proposed revision to the training syllabus was investigated. This program would add (3) low level sorties bringing the total number of low level flight sorties to (11). This would provide 1.2% of the syllabus for low level flight, navigation and NOE flight. Additionally, (4) air combat maneuvering (ACM) sorties would be added to the total syllabus.

To date no anti-armor training has been addressed by the attack helicopter community. No emphasis has been placed on anti-armor tactics or involvement with a combined arms army as employed by the Soviet forces. Clearly the present tactical training of U.S. Marine Corps attack helicopter crews is inadequate in the face of the known threat.

What are the training considerations in view of the known threat?

The researcher has presented the potential enemy - a combined arms army as employed by the Soviet Union. Current U.S. Marine Corps attack helicopter crew training has been examined. In the light of the known threat training is inadequate, what are the alternatives? The alternatives are to either disregard the attack helicopter as an anti-armor weapons system or to revise the training and make it mission oriented. The latter is the course the writer will take. Basic U.S. Marine Corps doctrine dictates that all training be mission oriented. A careful examination of the AH1T "TOW Cobra" is essential prior to a discussion about training. The AH1T or "TOW Cobra" has as its primary weapon the XM65 TOW missile system and the GTU-1A 20mm cannon mounted on the nose turret as a secondary weapon. Wing mounted weapons also include gun and rocket pods. Additionally tested was the XM128 helmet sight subsystem.¹¹ The TOW missile system is designed to defeat armored vehicles, fixed fortified emplacements and other hard point targets. The missiles are carried on the Cobra's outboard wing stations in a (2) or (4) tube configuration. The weight of a (4) missile load is 671 pounds. A maximum of (8) missiles can be carried, (4) on each outboard wing station. The missile contains both IR source and the wire dispensers required for guidance. Launch speed is Mach 1 shortly after launch, then slowly decreases. Wire cut automatically occurs when the IR signal is lost.¹² The following is a list of TOW missile characteristics:

Length	50.0 inches
Diameter	8.25 inches
Weight	52 pounds
Range	500-3000 meters
Launch speed	0-170 KCAS
Azimuth Firing Constraints	+ 2.4°
Elevation Firing Constraints	+ 5°, -7°
Roll Firing Constraints	+ 5°

The target for the TOW may be acquired by either the helmet sight or the TOW sight unit. Either the pilot or the gunner may visually acquire a target with the helmet sight. The TOW sight is then slaved to this target. The gunner must acquire the target on the TOW sight, while the pilot maneuvers the helicopter to meet the pitch, roll and yaw constraints. When these constraints are met, a READY flag is displayed in the TOW sight and the gunner may then fire a missile. If the IR detector fails to capture the missile 1.85 seconds after launch, automatic wire cut occurs at the launch tube. Loss of the IR signal for 0.5 seconds during guidance initiates an automatic wire cut. The wire may also be cut manually by either pilot or gunner.¹⁴ The following is a comparison of missile time and distance. These figures are for a hover launch.

3000 meters	15.0 seconds
2000 meters	8.8 seconds
1000 meters	4.0 seconds
500 meters	2.0 seconds ¹⁵

Each "TOW Cobra" when fully loaded has the potential to destroy (8) tanks. Additionally, the AHIT can carry (750) rounds of 20mm High Explosive Incendiary (HEI) and (2) seven shot 2.75 inch rocket pods (LAU-68/A) or (2) mini gun pods (SUU-11A/A).¹⁶

The cost trade off between an attack aircraft and a tank is about 1 aircraft for 12 tanks. This means attack aircraft must be able to penetrate and strike time after time in order to pay off.¹⁷

The cost trade off is considerably less with the attack helicopter. Additionally, in no test case studied were the ratios of tank loss to helicopter loss less than 16 to 1.¹⁸ To achieve the required kill ratios takes more than a good aircraft and weapons system. The most important factors are the "esprit" of the crew and the training. "Esprit" and moral courage are derived from a multitude of factors, none of which is being covered in this paper. Suffice it to say that this researcher believes the U.S.

Marine Corps has and will always have the men with the required "esprit" and moral courage necessary to accomplish the mission. Proper training is, as stated, essential for mission success. The training must fit the equipment, the men, and the enemy. It must be realistic, demanding, and as professional as possible. The Marine Corps has the attack helicopter, it will soon have the TOW missile system, and it has the men. Now the weapons system and the men must be trained to fit the enemy situation. No one system can succeed alone. In all discussion the researcher will integrate the attack helicopter with the rest of the combined arms team. Initial training will be conducted in isolated conditions but in all cases will lead to a combined tactical effort.

The TOW missile system has been proven successful against armored vehicles in both the Republic of Vietnam¹⁹ and the October 1973 War.²⁰ The tactics of low level, low level terrain, and NOE flight of the U.S. Army has been proven successful in the 1st Combat Aerial TOW Team exercises,²¹ the Ansbach tests,²² and the "Reforger" exercises.²³ In all cases the attack helicopters had to penetrate the FEBA, mass for the attack, attack, and then retire. The methods utilized were low level until within range of search radars, then low level terrain flight, and, finally, NOE flight to mask the attack ships from the air defense weapons. Infiltration techniques were utilized to penetrate the FEBA, massing at predetermined positions for the attack. It was possible to carry out the mission with minimum use of radio communication.

The training to accomplish this must include in-depth analysis of enemy doctrine and tactics. Further, thorough knowledge of enemy weapons systems is a must. Emphasis must be placed on low level flight navigation techniques. All phases of low level flight must be mastered both day and

night, foul weather or fair. The enemy stresses "around the clock" operations.

Mastery of the present weapons systems must be attained; excellent gunnery is the mark of a professional attack pilot. Engagement times (acquisition to kill) must be kept to an absolute minimum. At maximum range (3000 meters) anything over 20 seconds is considered unsatisfactory.²⁴ With the advent of TOW firing from defilade any engagement time (unmask to kill) over 10 seconds will be unsatisfactory.²⁵ Coordination between pilot and gunner must be smooth and instantaneous. Crews should be "married up" in much the same way as fighter pilots and radar intercept officers. Intercockpit coordination is an absolute necessity.²⁶

Once individual skills are mastered, multi-ship operations must be tackled. The U.S. Army found that a combination of (1) Scout to (2) attack ships was the most advantageous formation.²⁷ The researcher finds little use for the Scout. Why not use 2, 3, or 4 attack ships to form a section or division?

With the multi helicopter operations conquered, the next logical sequence is to operate with the rest of the combined arms team. Utilization of a combined artillery, fixed wing, and attack helicopter operation against an armored element with air defense and electronic warfare capability will require thorough preparation. Naval gunfire should also be included. Each of these systems will compliment the success of the other system. Artillery and naval gunfire reduces the air defense weapons effectiveness by stripping away many radar antennas and reducing the optics by forcing the armored vehicles to "button up." The fixed wing and rotary wing equally compliment each other. Radio communication should be held to an absolute minimum.

The attack helicopter and the AF CAS offer the ground commander a complimentary capability in terms of a wider spectrum of fire support, enhanced responsiveness, flexibility and capability.²⁸

Finally, and by no means the least consideration, is an appropriate air to air program. The need has been significantly identified by the Israeli Air Force²⁹ and by the proposed changes to the Training and Readiness Manual Chapter 16 in the U.S. Marine Corps attack helicopter training syllabus.³⁰ But by far the most significant requirement for this type of training is the advent of a challenge, the Mi-24 "Hind."³¹ This attack helicopter presents a new dimension in helicopter warfare. In reality it presents the same dimension that the fixed wing community experienced early in WWI.

Revamping the training syllabus will be necessary to accomplish the mission. With the exception of the initial aircraft familiarization phase, initial gunnery phase, carrier qualification, and instrument training, all flight training should be conducted in the low altitude flight regime. The flight training syllabus would then reflect over 60% of the sorties in the low altitude environment. Additional sorties would be required in the combat capable training phase (5 sorties basic low altitude/NOE instruction) and ACM sorties in the combat qualification training stage and full combat qualification training stage (4 sorties each stage). The last three phases would show that no less than 80% of the sorties would be in the low altitude environment. Only in the initial phase would the normal altitude environment dominate.

Discussion

Careful inspection of the formidable Soviet air defense umbrella will identify weapons which can be regarded as a high threat to the attack

helicopter. The weapons are low altitude, close in systems. They are the SA-7, SA-8, SA-9, ZSU-23-2 or 4, the 12.7mm and 14.5mm guns.

A strong ECM effort can deny success for the SA-7, SA-8, and SA-9. However, the ZSU-23's, 12.7's and 14.5's have an excellent optic mode which cannot easily be defeated. Smoke can reduce optical systems effectiveness; this same smoke also obscures the target for the attacker. By remaining in a masked position until engagement, NOE and low level terrain flight can be extremely effective.

Even during engagement any movement can detract from the effectiveness of the air defense guns. In the 1972 Hunter-Liggett Military Reservation test 50% of the time the AH1 was detected within 16 seconds after unmasking.³² Simulating a ZSU-23-4 firing from 3000 meters, the first burst arrived at the helicopter 8 seconds after sighting; the second burst 12 seconds and the third burst 16 seconds. These were 1 second bursts with a 2 second interval.³³ An accelerating maneuver did perturb the hit probability. However, care must be taken not to snag the TOW signal wires and no gain in altitude can be tolerated due to increased exposure.³⁴

The method of firing the TOW from a defilade position was tested and with the necessary equipment can deliver hits with only 10 seconds of exposure time at maximum range (3000 meters). The attack ship unmask, acquires the target, obtains accurate laser range, and then enters the range and the inertial coordinates of the target into a central digital computer. The helicopter then remasks and proceeds NOE towards a firing position. The gunner aligns his stabilized sight by utilizing the computer generated leading reference. When in firing position, the TOW is fired skyward. Since the range to the target is known, the missile follows a slightly ascending trajectory until the helicopter unmask and achieves

target visibility. Visual target acquisition occurs about 3 seconds prior to missile impact for terminal guidance of the missile. Total exposure time is 10 seconds.³⁵ This is possible with present state of the art avionics at a cost of about \$50,000. Additional equipment would be an inertial platform, a central digital computer, computer programming to compute launch maneuver profile and a TOW missile in-flight status display.³⁶ So much for the future; at present low altitude flight is the only arena in which the attack helicopter can survive. But it is beyond survival; NOE can assure mission accomplishment.

The training program can provide the necessary expertise. Modification to the present Training and Readiness Manual can be the instrument which delivers the expertise. A proposal which could provide this would be along the following lines.

Combat Capable Training

<u>Stage</u>	<u>Sortie Normal</u>	<u>Sortie Low Altitude</u>	<u>Hours</u>
Familiarization	10		19.0
NOE/Low altitude familiarization		5	7.5
Instrument	8		16.0
Night familiarization	2		3.0
Navigation		4	6.0
Formation	4		8.0
Visual reconnaissance		2	3.0
Visual ordnance	5		7.5
Tactics		2	3.0
Combat capable check		1	1.5
	<u>29</u>	<u>14</u>	<u>74.5</u>

Combat Ready Training

<u>Stage</u>	<u>Sortie Normal</u>	<u>Sortie Low Altitude</u>	<u>Hours</u>
Tactical instrument	2		4.0
Visual ordnance		5	7.5
Advanced navigation		3	4.5
Supporting arms coord.		3	4.5
	<u>2</u>	<u>11</u>	<u>20.5</u>

Combat Qualification Training

<u>Stage</u>	<u>Sortie Normal</u>	<u>Sortie Low Altitude</u>	<u>Hours</u>
Armed Escort		2	3.0
Advanced visual ord.		5	7.5
Advanced tactics		3	4.5
Advanced instrument	3		6.0
Air combat maneuvering		4	6.0
Attack helicopter Cmdr. check	<u>3</u>	<u>2</u>	<u>3.0</u>
		16	30.0

Full Combat Qualification Training

<u>Stage</u>	<u>Sortie Normal</u>	<u>Sortie Low Altitude</u>	<u>Hours</u>
Advanced visual ord.		5	7.5
Advanced supporting arms coord.		5	7.5
Field carrier landing practice	2		2.0
Carrier qualification	3		3.0
Mountain area training		5	7.5
Advanced ACM		4	6.0
Attack helicopter Cmdr. check	<u>5</u>	<u>1</u>	<u>1.5</u>
		20	35.0

This would provide 80% of the training in the low altitude mode for the last three stages of training. Extensive night operations would have to be included after full day qualifications are completed. In no instance should a low altitude or NOE sortie exceed 1.5 flight hours. In no instance should a night low altitude or NOE sortie be preceded by a day sortie within the same 24 hour period. The night syllabus must be carefully planned and preferably executed in one phase. A recommended night syllabus would be along the following lines.

Night Low Altitude/NOE Training

<u>Stage</u>	<u>Sortie</u>	<u>Hours</u>
Familiarization	5	7.5
Advanced night navigation	3	4.5
Advanced night supporting arms coord.	3	4.5
Advanced night visual ord.	3	4.5
Advanced night tactics	3	4.5
Night NOE Cmdr. check	<u>2</u>	<u>3.0</u>
	19	28.5

Currency under night NOE conditions will be extremely hard to maintain. However, it will be the most demanding type of flying and under no circumstances should a "casual lip service" type approach be made to this type of flying. It might be feasible to consider one month semi-annually for a total squadron night schedule or only minimal day flights with the majority of the flight schedule at night.

All subsequent squadron training should reflect no less than 80% low altitude flight. Tactically the researcher is opposed to the utilization of scout helicopters. It makes no sense to maneuver into an enemy area and then have to rely upon communication to position the attack ships to engage a target.

Massive infiltration tactics are necessary to arrive at pre-determined marshalling points. Large "kill zone" tactics must be utilized. Coupling this with artillery/naval gunfire support and fixed wing support (weather permitting) great success can be achieved against a large armored force. The most favorable attack conditions will be a rapidly moving armored force; the least favorable will be a statically deployed defensive armored/mechanized force. The reasons are most apparent. In the defense the enemy will be able to maximize the use of cover and concealment, his communications will be better, fire more coordinated, and the noise of the helicopter will not be masked by the "rumbling armor." The coordinated attack will virtually ensure success if properly executed. Retirement should once again utilize individual infiltration techniques, quickly refueling and rearming for continuous attack. Dispersal of assets will be necessary for survival. Only during the attack should the helicopters be massed. While operating aboard ship this presents no problem. Once ashore, however, dispersal will be necessary.

New gunnery ranges will have to be developed to enable pop-up firing and, of course, utilization of the TOW. Stress must be placed on target identification, acquisition and destruction. Complete knowledge of weapon systems is mandatory. Know the enemy, his weapons and tactics.

Air to air combat must be introduced and detailed tactics examined and adopted. The basic rules of ACM apply whether flying fixed or rotary wing. The enemy's potential in this area could be staggering. Knowledge and skill developed through proper training, coupled with the desire for victory, could well be the deciding factor. Let's not be found wanting.

Essentially a change in direction is needed; to face the future and conquer it has always been the challenge of the Corps. Marines have always been at the forefront in meeting this challenge. There is no reason to stumble in an area that has been the Marines forte, training - training to meet the threat of the next war - not of the war just passed. The Corps has always preached and employed the air/ground team. Now more than ever this highly trained, properly balanced team is essential for victory.

Chapter V

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

Summary

The combined arms army, with its mobile air defense umbrella, poses a formidable threat. The conventional use of aviation assets to attrite this totally motorized/armored force will be extremely costly. Lessons learned from the October 1973 Arab-Israeli Conflict point to a modified use of aviation assets. That war reaffirmed the combined arms concept. Considering the vast number of armored systems which the potential enemy has, massive destruction of armored targets with conventional weapons will have to be accomplished in a short time span.

The attack helicopter, with the TOW missile system, utilizing proper tactics, can measurably assist in the servicing of armored targets. The real air defense threats to the attack helicopters are the low altitude "close in" weapons. The SA-7, SA-8, SA-9, ZSU-23-2 or 4 and the 12.7mm or 14.5mm guns. Low altitude terrain masking flight does provide a tactic which is viable. The attack helicopter can infiltrate, flank, mass, attack and retire with a high degree of success. The tactics best suited for the attack helicopter are low level, infiltrating or flanking the FEBA to attack a rapidly moving armored force, in conjunction with an exploitation force after a breakthrough, or attacking an armored force attempting a penetration.

The advent of the AH1T "TOW Cobra" in the United States Marine Corps requires the Corps to train attack helicopter crews in a realistic

manner. The weapon system is designed to destroy armor. Now the Corps must train to meet the potential enemy.

Examination of present training in the Marine attack helicopter community indicates a total lack of viability on the mid-intensity battlefield. Less than 2% of the training involves low level techniques which are a necessity in the anti-armor role on a modern battlefield. Further, no training is being conducted for the battlefield without total air supremacy. The helicopter can survive against fixed wing with proper defensive tactics. No considerations are being given to a helicopter vs helicopter situation. This, in the face of the Mi-24 "Hind," is a complete oversight. It is hard to imagine ever again operating in the Republic of Vietnam environment circa 1963 - 1970. True "around the clock" operations must be considered. Training in this area will prove most arduous but the days of night operations left only to a select few are over. Low level/NOE operations are a must; not to train for this type of warfare borders on neglect.

Revamping the attack helicopter training and readiness requirements are essential. It cannot be left for the future . . . the future is here. The Corps has the equipment, the AH1J; the system will be here, the AH1T; and the men. Let's begin now to train for the next war.

The first resistance will be met in the field of aviation safety. This is by no means a casual program. With proper planning, careful study and exacting execution adequate safety can be maintained. There will be incidents and even accidents, but what is the alternative? To be untrained for combat is criminal neglect; this is not the way of the Corps. The Marines are and always have been a mission oriented force. Great strides have been made in the employment of helicopters on the modern battlefield. These ideas can be blended into an unique adaptation that

will fit the Corps mission requirements.

Conclusions.

Is a change in the tactical training of Marine Corps attack helicopter pilots essential to perform the anti-armor mission? The answer to this question is resoundingly affirmative! The total training program must be redirected to perform the anti-armor mission.

The attack helicopter community must be accepted as a viable weapons system. With this acceptance the training will change and proceed in the appropriate direction. The system is built around the AH1 "Cobra." Working methodically from initial transition to final qualification, with the primary mission as anti-armor, the appropriate training will occur.

Low level/NOE is a proven concept. The tactics of infiltration, flanking, massing, attacking and retiring is a proven concept. Couple this with a combined arms operation, and victory will not be denied. The concept of operation must be day and night, foul weather and fair. Air to air tactics and training must be incorporated. Attack helicopter training against fixed wing and rotary wing has become essential. The basics remain the same; the expertise exists totally within the Corps; this source must be tapped. Professionalism has long been the watchword of Marine Aviation, a professional approach in this area can and will succeed.

The attack helicopter has truly come of age. Operation on a mid-intensity battlefield is essential. The area of potential conflict in Europe presents weather conditions which will prevent fixed wing close air support operations 50% of the time. The attack helicopter can successfully operate in these conditions. The helicopter can operate on a battlefield in which air supremacy is not total. It can operate in a hostile air environment, in bad weather, at night, and against a formidable air defense

system. The realistic training of flight crews will further enhance the Corps "force in readiness."

Recommendations

This research has dealt with the threat, present training, and a proposed change in training. The current training syllabus is clearly inadequate. A recommended syllabus has been presented in Chapter IV. These changes reflect that 80% of the training in the last three stages are low level terrain flight. A complete low level night syllabus has been added. Finally all subsequent squadron flight training should provide no less than 80% in the low level terrain mode. The only flight training conducted in the higher altitude environment should be the initial aircraft familiarization phase, initial gunnery phase, carrier qualification, and instrument training.

Further research should be conducted in the adequacy of present equipment. What modification could be made to improve this equipment? What equipment is required that is available now? What will be required in the future? The area of electronic warfare would be impossible to broach on an unclassified basis, however, that area needs close examination.

The idea behind this paper is to gain attention in an area where appropriate attention has been lacking. The best qualified personnel to build a training syllabus which would be adequate exists in the squadrons HMA 169, 269, and 369. Further expertise exists at MAWTUPAC and MAWTULANT. Inputs to the annual Training and Readiness Conference could provide the necessary data to compile such a syllabus. This will not occur unless specifically tasked by Headquarters Marine Corps.

Chapter II

ENDNOTES

1. James H. Merryman, "Bring Army Aviation through 70's & 80's," USA Aviation Digest, 20:2, June, 1974.
2. Military Operations of the Soviet Union, United States Army Intelligence Threat Analysis Detachment, May 25, 1976, p. 90.
3. Ibid., p. 30.
4. Employment of Army Aviation Units in a High Threat Environment, FM 90-1, Headquarters Department of the Army, September 30, 1976, pp. 2-3.
5. André Deutsch, Insight on the Middle East War, (London: Times Newspaper Limited, 1974), p. 83.
6. Ibid., p. 94.
7. Ibid.
8. Mohamed Heikal, The Road to Ramadan, (New York: The New York Times Book Co., 1975), p. 60.
9. Ibid., p. 226.
10. Louis Williams, Military Aspects of the Israeli-Arab Conflict, (Tel Aviv: University Publishing Projects, 1975), p. 245.
11. Employment of Army Aviation Units in a High Threat Environment, FM 90-1, op. cit., p. 2-7.
12. "SA-6 Arab Ace in the 20 Day War," International Defense Review, 6:780, December, 1973.
13. C. A. Robinson, "Anti-tank Helicopter Training Spurred," Aviation Week and Space Technology, 103:41, October 20, 1975.
14. Douglas H. Madigan and Richard S. Van Pelt, "The Armed Helicopter . . . What's Next?" Armor, 84:13, March-April, 1975.
15. Employment of Army Aviation Units in a High Threat Environment, FM 90-1, op. cit., pp. 2-16.
16. AHIG/J Aviation Training and Readiness Manual, Chapter 16, United States Marine Corps, 1976, p. 16-4.

17. Ibid., p. 16-10.
18. Ibid., p. 16-4.
19. Ibid., p. 16-13.
20. Ibid., p. 16-4.
21. Ibid., p. 16-15.
22. Ibid., p. 16-5.
23. AH1G/J Aviation Training and Readiness Manual (Proposed), Chapter 16, United States Marine Corps, June 30, 1976, p. 20.
24. Army Training and Evaluation Program for the Attack Helicopter Battalion, Department of the Army, September, 1976, p. 1.
25. Ibid., p. 8-3-1.
26. Merryman, op. cit., p. 3.
27. Fredrick L. Gatz, "Training Helicopter Crews," Marine Corps Gazette, 59:50, April, 1975.
28. Richard N. Blunt, "Concepts and Ideas NOE," USA Aviation Digest, 20:8, January, 1974.
29. Ibid., p. 11.
30. Orval Right, "NOE at Night," USA Aviation Digest, 20:34, March, 1974.
31. Ibid., p. 39.
32. Ibid.
33. Ralph S. Park, "Getting Started (Initiation of the 155th Aviation Company "owl team" Training Progress in Night NOE)," USA Aviation Digest, 20:20, March, 1974.
34. Robinson, op. cit., p. 44.
35. Thomas J. Marshall, "Israeli Helicopter Force: Organization and Tactics," Military Review, 52:97, July, 1972.
36. Joe D. Watson, "Marine Helicopters-Stunted Growth (need for a development program to improve helicopter equipment and tactics)," U.S. Naval Institute and Proceedings, 99:37, July, 1973.
37. Harvey F. Jossen, "Air to Air Combat for Helicopters," USA Aviation Digest, 20:12, July, 1974.
38. Madigan, op. cit., p. 15.

39. Ibid.
40. AH1G/J Aviation Training and Readiness Manual (Proposed), op. cit., p. 20.
41. Rush R. Wicker, "TC 1-4 Air Crew Gunnery Accuracy = Staying Power Survivability," USA Aviation Digest, 21:25, December, 1975.
42. "Helicopter Anti Tank Role Expanded," Aviation Week and Space Technology, 99:55, November 12, 1973.
43. Michael S. Lopez, "Terrain Flying in Bavaria. . .Reforged 74," USA Aviation Digest, 21:21, February, 1975.
44. Williams, op. cit., p. 257.
45. S. L. Christine, "1st Combat Aerial TOW Helo vs Armor," USA Aviation Digest, 20:5, February, 1974.
46. John R. Mills, "Air Assault Update. . . A Unit Commander's View," USA Aviation Digest, 21:28, September, 1975.

Chapter IV

ENDNOTES

1. Williams, op. cit., p. 28.
2. Ibid., p. 29.
3. John Erickson, Some Developments in Soviet Tactical Aviation, 1975, p. 73.
4. Thomas E. Bearden, Soviet Air Defense Concepts, 1975, p. 4.
5. Military Operations of the Soviet Army, op. cit., p. 30.
6. Ibid., p. 242.
7. Madigan, op. cit., p. 13.
8. Military Operations of the Soviet Army, op. cit., p. 246.
9. Williams, op. cit., p. 257.
10. AHIG/J Aviation Training and Readiness Manual, op. cit., p. 16-4.
11. TOW Weapons System Description, TPS-16R-75, 1975, p. 33.
12. Ibid., p. 34.
13. Ibid., p. 35.
14. Ibid., p. 36.
15. Ibid.
16. Ibid., p. 49.
17. "Yom Kippur Fighting Underscores EW Importance," Electronic Warfare, 6:30, January-February, 1974.
18. Christine, op. cit., p. 5.
19. Ibid.
20. Heikal, op. cit., p. 226.
21. Christine, op. cit., 5.

22. Helicopter Anti Tank Role Expanded, op. cit., p. 55.
23. Lopez, op. cit., p. 21.
24. Edward Stephans, "Avionic and Fire Control Equipment to Enhance Attack Helicopter Survivability," American Helicopter Society, May, 1974, p. 5.
25. Ibid., p. 6.
26. Park, op. cit., p. 20.
27. Christine, op. cit., p. 5.
28. "Air Force, Army Agree on Role of Attack Copters in Close Air Support," Air Force Times, 36:4, September 17, 1975.
29. Marshall, op. cit., p. 97.
30. AHIG/J Aviation Training and Readiness Manual (Proposed), op. cit., p. 20.
31. Madigan, op. cit., p. 13.
32. Stephans, op. cit., p. 4.
33. Ibid., p. 6.
34. Ibid.
35. Ibid., p. 7.
36. Ibid.

BIBLIOGRAPHY

Books

Deutsch, André. Insight on the Middle East War. London: Times Newspaper Limited, 1974.

Heikal, Mohamed. The Road to Ramadan. New York: The New York Times Book Co., 1975.

Williams, Louis. Military Aspects of the Israeli-Arab Conflict. Tel Aviv: University Publishing Projects, 1975.

Periodicals

"Air Force, Army Agree on Role of Attack Copters in Close Air Support," Air Force Times, 36:4, September 17, 1975.

"Army Plans Helicopter Changes as Strella Missile Use Continues," Aviation Week and Space Technology, 97:18, July 17, 1972.

Blunt, Richard N., "Concepts and Ideas NOE," USA Aviation Digest, 20:6-11, January, 1974.

Brown, Michael J., "Missile, Missile, Missile! (SA-7 Strella)," USA Aviation Digest, 21:30-33+, April, 1975.

Christine, S. L., "1st Combat Aerial TOW Helo vs Armor," USA Aviation Digest, 20:2-5, February, 1974.

Cohen, R. J., "Helicopter - Panacea or Pipe Dream," Army Q, 103:420-439, July, 1973.

"Design Trends in AAA Threat Simulation Radars," Electronic Warfare, 7:46-47+, March-April, 1975.

Drumheller, Phillip M., "Effective Communication and NOE Target Recognition," USA Aviation Digest, 20:16-20, April, 1974.

Gatz, Fredrick L., "Training Helicopter Crews," Marine Corps Gazette, 59:49-50, April, 1975.

Hanby, John B., Jr., "Fire Control Modes: Hellfire," USA Aviation Digest, 21:24-27, January, 1975.

Heaton, David R., "Night Hawk Training Test, The Overview," USA Aviation Digest, 21:1-3, December, 1975.

- "Helicopter Anti Tank Role Expanded," Aviation Week and Space Technology, 99:54-44, November 12, 1973.
- "Helmet Sights Lets AH56 Pilot Train on Target by Moving Head," Aviation Week and Space Technology, 88:76+, April 8, 1968.
- Jossen, Harvey F., "Air to Air Combat for Helicopters," USA Aviation Digest, 20:12-17, July, 1974.
- Lopez, Michael S., "Terrain Flying in Bavaria Reforger 1974," USA Aviation Digest, 21:6-7+, February 1975.
- Madigan, Douglas H., and Van Pelt, Richard S., "The Armed Helicopter . . . What's Next? (Helo vs Helo Aerial Combat)," Armor, 84:12-15, March-April, 1975.
- Maleyev, Alexander, "Soviet Mi-24 (Hind) Combat Helo," International Defense Review, 8:879-881, December, 1975.
- Marshall, Thomas J., "Israeli Helicopter Force: Organization and Tactics," Military Review, 52:94-99, July, 1972.
- Meller, R., "The TOW Cobra Anti-Tank Helicopter . . . More Mobile Fire Power for the U.S. Army in Europe," Defense Review, 8:882-886, December, 1975.
- Merryman, James H., "Bring Army Aviation Through 70's and 80's," USA Aviation Digest, 20:2-5, June, 1974.
- Mills, John R., "Air Assault Update . . . a Unit Commander's View," USA Aviation Digest, 21:6-7+, September, 1975.
- "New Details on the SA-6," International Defense Review, 7:529, August, 1974.
- O'Grady, George L., "The Shotgun is Here! (2.75 inch Folding Fin Aerial Rocket FFAR)," USA Aviation Digest, 21:10-13, April, 1975.
- "Passive Defense System Studied for New Tactical Helicopter," Aviation Week and Space Technology, 98:13, January 22, 1973.
- Park, Ralph S., "Getting Started (Initiation of the 155th Aviation Company Owl Team Training Progress in Night NOE)," USA Aviation Digest, 20:3-5+, March, 1974.
- "Pave Low III (Modified Sikorsky HH-53 for Night Rescue Capability)," Air Force Magazine, 59:18, February, 1976.
- Right, Orval, "NOE at Night," USA Aviation Digest, 20:2+, March, 1974.
- Robinson, C. A., "Anti-tank Helicopter Training Spurred," Aviation Week and Space Technology, 103:41-43+, October 20, 1975.
- "SA-6 Arab Ace in the 20 Day War," International Defense Review, 6:779-781, December, 1973.

- Tidney, Charles M., "Project Rave," USA Aviation Digest, 21:8-11, February, 1975.
- Turley, G. H., "Time of Change in Modern Warfare," Marine Corps Gazette, 58:16-20, December, 1974.
- Watson, Joe D., "Marine Helicopters - Stunted Growth (Need for a Development Program to Improve Helicopter Equipment and Tactics)," U.S. Naval Institute and Proceedings, 99:34-41, July, 1973.
- Wicker, Rush R., "TC 1-4 Air Crew Gunnery Accuracy = Staying Power Survivability," USA Aviation Digest, 21:24-25, December, 1975.
- Wilkin, Michael J., "Covert Night Multi Aircraft Operational Capability (Station Keeping Lights and Their Value to Night Tactical Operations)," USA Aviation Digest, 20:14-17, December, 1974.
- "Yom Kippur fighting underscores EW Importance," Electronic Warfare, 6: 24-25+, January-February, 1974.

Publications

- "AHIG/J Aviation Training and Readiness Manual," Chapter 16, United States Marine Corps, 1975, 19 pp.
- "AHIG/J Aviation Training and Readiness Manual," Chapter 16, United States Marine Corps, Proposed June 30, 1976, 34 pp.
- "Air Assault and Air Cavalry Combat Brigade Operations," FM 17-47 (Draft), U.S. Army Command and General Staff College, 104 pp.
- "Army Training and Evaluation Program for the Attack Helicopter Battalion," Department of the Army, September, 1976, 77 pp.
- "Attack Helicopter Operations," FM 17-50, U.S. Army Armor School, May, 1976, 119 pp.
- Bearden, Thomas E., "Soviet Air Defense Concepts," 1975, 6 pp.
- Bynum, James A., Shipley, Brian D., and White, William C., "Helicopter Night Low-Level Navigation," American Helicopter Society, May, 1976, 6 pp.
- "Employment of Army Aviation Units in a High Threat Environment," FM 90-1, Headquarters Department of the Army, September 30, 1976, 151 pp.
- "Employment of Attack Helicopters," U.S. Army Command and General Staff College, September 1, 1976, 14 pp.
- Eriekson, John, "Some Developments in Soviet Tactical Aviation," 1975, 5 pp.
- "Military Operations of the Soviet Army," United States Army Intelligence Threat Analysis Detachment, May 25, 1976, 248 pp.

Stephans, Edward, "Avionic and Fire Control Equipment to Enhance Attack Helicopter Survivability," American Helicopter Society, May, 1974, 8 pp.

"TOW Weapons System Description," TPS-16R-75, 1975, 19 pp.